

ACANTHOCEPHALA OF THE GENERA CENTRORHYNCHUS AND MEDIORHYNCHUS (NEW GENUS) FROM NORTH AMERICAN BIRDS*

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INTRODUCTION

The writer has made a thorough study of the avian Acanthocephala in the collections of the U. S. Bureau of Animal Industry. In this study a number of specimens comprising four undescribed species have been discovered in which the proboscis receptacle finds its insertion near the middle of the proboscis wall. This method of insertion is characteristic of but a single known genus of Acanthocephala. The morphology of the four newly discovered species possessing a proboscis receptacle of this type varies too broadly in points of fundamental structure to permit of including all four species within the Genus *Centrorhynchus*. But one species of the four, and that represented by a single individual in the collection under consideration, agrees with the characters of the genus *Centrorhynchus* as given by Lühe (1911:41). For the other three species the writer has found it necessary to create a new genus, the characters of which are enumerated in another part of this paper.

METHODS

The specimens for study have been stained in toto with Ehrlich's acid hematoxylin, dehydrated, cleared in synthetic oil of wintergreen, and mounted in damar. All the drawings have been made with a camera lucida.

GENUS CENTRORHYNCHUS Lühe 1911

The genus *Centrorhynchus* comprises a well defined group of parasitic worms, belonging to the Class Acanthocephala, which reach maturity in the alimentary canal of birds. One of the most striking characteristics of this genus is the insertion of the proboscis

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receptacle in the middle of the proboscis wall. This peculiar departure from the ordinary arrangement of the organs and parts of the body, while not the sole means of distinguishing the members of this genus, has lead to considerable confusion among various workers. The attempt on the part of some investigators to homologize the basal region of the proboscis with the neck characteristic of some of the other genera of *Acanthocephala* has been most distinctly refuted by Lühe (1912:274). He has shown that if the insertion of the proboscis receptacle marks the boundary between neck and proboscis the genus *Gigantorhynchus* must be considered as having no true proboscis for, according to Lühe's observations, the proboscis receptacle in the genus *Gigantorhynchus* finds its insertion at the tip of the organ of fixation, which, according to the proposed distinction, would of necessity be considered an armed neck. The folly of this argument is self evident. There is no reason for doubting that the organ of attachment in the genus *Gigantorhynchus* is a true proboscis. Similarly the spined regions both anterior to and posterior to the insertion of the proboscis receptacle constitute the proboscis of the *Centrorhynchi*.

Little has been done toward establishing the synonymy within the genus *Centrorhynchus*. Lühe (1911:41) has listed the forms from central Europe which might be attributed to it but has added the statement that at least some of the names included in his list are certainly synonyms. Kostylew (1914:186) has given a list of four species which he considered as valid for this genus but has not presented the data used in reaching his conclusion.

Of the species attributed to the genus *Centrorhynchus* but a single one has been reported from North America. Leidy (1888:22) has recorded the occurrence of individuals by him determined as "*Echinorhynchus caudatus* Zeder" from the swallow tail kite, *Elanoides forficatus* (*Elanoides furcatus*)* and two specimens of the same species from the owl *Scotiaptex nebulosa* (*Strix nebulosa*). The specific identity of these specimens with the European species must be sharply questioned, for, as earlier works of the writer have shown, the *Acanthocephala* of North America, and

*Here, and elsewhere in the text, scientific names of birds quoted from another writer or taken from records accompanying the collections follow in parenthesis after the name given for the species in the A. O. U. Check List.

especially those from fresh-water and terrestrial hosts, constitute a list of forms in the main peculiar to the American continent. A fuller account of the evidences of this development is given at the end of this paper.

On the basis of the present study it becomes impossible to determine whether the Acanthocephala described by Leidy belong to the Centrorhynchi or the genus Mediorhynchus. The only valid record of a species of Centrorhynchus from North America is in a single collection of one individual in the Collections of the Bureau of Animal Industry. A comparison of this specimen with descriptions of other species of the genus has revealed differences which make it necessary to consider this a new species. The specific diagnosis follows.

CENTRORHYNCHUS SPINOSUS NOV. SPEC.

(Figs. 1-3)

Specific diagnosis. With the characters of the genus. Proboscis closely set with numerous hooks. Species description based on a single female which becomes type. Body 20 mm. long; diameter anterior part of body slightly larger (6.6 mm.) than posterior part (0.5 mm.); posterior extremity slightly pointed, conical. Proboscis 0.65 mm. long; with hooks of two distinct types, those anterior to insertion of proboscis receptacle with recurved roots; strongest hooks (0.038 mm. long) appearing near the middle of the proboscis just behind the cylindrical apical portion. Hooks in thirty-two longitudinal rows of about twenty-four hooks each. Hooks posterior to insertion of proboscis receptacle thornlike, about 0.05 mm. long, often with recurved tips. Proboscis constricted at insertion of proboscis receptacle, diameter at constriction 0.25 mm.; posterior portion (0.35 mm. in diameter) not sharply set off from body proper; slightly swollen anterior to insertion of receptacle; tip smaller, cylindrical, 0.17 mm. in diameter.

Type host *Herodias egretta* (*Ardetta egretta*), in intestine. Collected by Hassall, Sept. 1894. Type deposited in the U. S. Bureau of Animal Industry Helminthological Collections. Catalog number Hassall Collection 6307.

In general body form this species closely resembles the figures given by Lühe (1911 Fig. 54) for *C. aluconis*. Unfortunately the

male of *C. spinosus* is unknown so a comparison of the male organs with those of *C. aluconis* must be deferred until other materials are available. One of the most strikingly characteristic points about this species is the abundance of the spines (see Figs. 1 and 2). The entire proboscis, even under a low power of the microscope, fairly bristles with projecting spines. While the hooks of the anterior part of the proboscis are stronger than those posterior to the insertion of the proboscis receptacle (see Fig. 3) the difference in size is not as conspicuous as in the species of *Mediorhynchus* described in this paper.

MEDIORHYNCHUS NEW GENUS

The remaining three species differ from the characterization of the genus *Centrorhynchus* in the following particulars: (1) The males possess eight rounded or pear shaped cement glands instead of the three long tubular cement glands described for *Centrorhynchus*. (2) The wall of the proboscis receptacle is composed of a single muscular layer instead of two layers as specified by Lühe for *Centrorhynchus* and shown in figure 2 of *C. spinosus*. (3) The invertors of the proboscis pass through the sides of the proboscis receptacle considerable distance from its base and continue backward through the body cavity as the retractors of the proboscis receptacle, while in *Centrorhynchus* the invertors pass through the wall of the receptacle at its rounded posterior extremity (see Fig. 10).

Generic diagnosis. Acanthocephala of medium size reaching sexual maturity in the alimentary canal of birds. Proboscis receptacle inserted near the middle of the proboscis wall. Receptacle a single walled muscular sac with invertors of proboscis passing through its wall some distance anterior to the posterior tip of the receptacle. Central nervous system near the center of the proboscis receptacle between the invertor muscles. Cement glands of male a compact mass of rounded or pear shaped glands, usually eight in number. Proboscis hooks of two distinct types; those anterior to the insertion of the proboscis receptacle in surface view with flask shaped roots, bases of roots broad; those on the posterior portion of the proboscis without reflexed roots. Embryos with three concentric membranes.

Descriptions of three species belonging to the genus *Mediorhynchus* follow:

MEDIORHYNCHUS PAPILLOSUS NOV. SPEC.

(Figs. 4-10)

Specific diagnosis. With the characters of the genus. Proboscis armed with inconspicuous hooks, each hook embedded in a papilla (see Figs. 5 and 8.). Body of both sexes cylindrical, almost uniform diameter throughout. Type male 9.3 mm. long; diameter 0.75 mm., tapering to 0.57 mm. at base of proboscis, and tapering slightly at posterior extremity. Cement glands (see Fig. 7) eight, rounded to pyriform, in compact mass slightly posteriad of posterior testis. Testes two, elongated, elliptical, contiguous; in chief axis of body. Proboscis 0.65 mm. long; largest diameter 0.30 mm., near the middle. Lemnisci 3 mm. long.

Type female 18 mm. long, diameter 0.75 mm., tapering to 0.57 mm. at base of proboscis. Embryos 0.038 to 0.047 mm. long by 0.018 to 0.024 mm. across, with three concentric membranes (see Fig. 9.).

Proboscis anterior to insertion of proboscis receptacle with eighteen longitudinal rows of six or seven hooks each, longest hooks 0.027 mm. long, each hook with a root process (0.040 mm. long) usually longer than the recurved spine (see Fig. 6.). Surface view of roots pyriform (see Fig. 8.). Hooks posterior to insertion of proboscis receptacle without reflexed roots; thornlike, with tips bent posteriorly almost at right angles to axis of the spine; four to six hooks in a longitudinal row.

Host *Myiochanes virens* (*Contopus virens*). Collected May 30, 1892, by Albert Hassall. Type male and type female deposited in the U. S. Bureau of Animal Industry Helminthological Collection. Catalog number 6320 Hassall Collection.

Besides the types of *M. papillosus* the collections of the U. S. Bureau of Animal Industry contain one specimen of this species, a male from the intestine of *Porzana carolina* in the Hassall collection, catalog number 6303. The locality from which this individual was taken is not given in the records accompanying the specimen.

MEDIORHYNCHUS GRANDIS NOV. SPEC.

(Figs. 11-14)

Specific diagnosis. With the characters of the genus. Specific description based upon the study of one male and three fully mature females, constituting two collections from different hosts. Body of females 27 to 35 mm. long, practically cylindrical; diameter anterior region 1.2 mm.; maximum diameter considerable portion in middle of body 0.9 to 1.4 mm.; diameter near posterior extremity 0.7 to 1.1 mm. Anterior and posterior extremities of body flexed ventrally. Anterior part of body just behind proboscis expanded and sharply set off from neck. Proboscis of all specimens partially inverted; largest female anterior to insertion of proboscis receptacle approximately 0.6 mm. long if extended (all but 0.3 mm. inverted in type); proboscis posterior to insertion of receptacle 0.6 mm. long. Hooks in anterior region of proboscis with massive roots; twelve longitudinal rows of approximately four hooks each (two in each row show on surface of inverted proboscis). Basal portion of proboscis with numerous small spines, not in perfect rows but about thirty longitudinal rows with three to six spines each. Hooks on anterior proboscis 0.05 mm. long (measurement taken as longest straight line from the tip of the spine to the region where the hook and root join). Length of root 0.075 to 0.086 mm. (from base of root to top of angle between root and hook). Embryos with three concentric membranes, about twice as long as broad; 0.043 by 0.021 mm.

Male 8.2 mm. long. Maximum diameter 1 mm.; diameter posterior tip 0.18 mm.; anterior to tip 0.5 mm. Diameter anterior end of the body proper 0.61 mm. Lemnisci about 2 mm. long. Testes oval, slightly separated, 1.2 mm. long and 0.35 mm. wide. Eight cement glands, each rounded, usually pear shaped.

Type host *Quiscalus quiscula*, in intestine. Cotypes deposited in U. S. Bureau of Animal Industry Helminthological Collection. Catalog number Hassall Collection 6319.

One fully mature female determined by the writer as belonging to this species has been found in the intestine of *Sturnella magna*. Collected by C. S. Brimley, Nov. 30, 1902, in North Caro-

lina. In the U. S. Bureau of Animal Industry Parasitological Collection. Catalog number 6772.

MEDIORHYNCHUS ROBUSTUS NOV. SPEC.

(Figs. 15 and 16)

Specific diagnosis. With the characters of the genus. Body both sexes robust, medium length; largest diameter near the middle, tapering slightly toward either end; dorsal surface slightly convex. Proboscis small, setting on obliquely truncated anterior end of body, pointing slightly ventrad. Lacunar system of subcuticula highly developed. Lemnisci about one-fourth to one-third the length of body. Specific descriptions based on one male and one female which become types.

Type female 16 mm. long. Maximum diameter body proper 2.4 mm., diameter posterior extremity 0.8 mm., anterior extremity 0.9 mm. Proboscis short, globular, 0.2 mm. in diameter; tip partially inverted and base partially retracted within body; exposed portion anterior to insertion of proboscis receptacle armed with twenty-four longitudinal rows of hooks. Hooks very small and inconspicuous with small pyriform roots 0.032 mm. long. Each hook in an elevation of the proboscis wall but not in a distinct papilla. Basal region of proboscis entirely retracted within body, hooks not observable.

Type male 7 mm. long, maximum diameter 1.25 mm.; diameter posterior extremity 0.52 mm.; anterior extremity the same. Proboscis short, globular, 0.156 mm. in diameter, partially inverted. Hooks small, inconspicuous, about 0.025 mm. long; only about 0.005 mm. extending beyond the elevations on proboscis.

Embryos 0.038 mm. long by 0.016 mm. wide.

Type host *Icteria virens* in intestine. Collected by A. Hassall at Washington, D. C., in June 1893. Type male and female deposited in the Helminthological Collection of the U. S. Bureau of Animal Industry, catalog number 2316.

FAMILY CENTRORHYNCHIDÆ

When Hamann (1892:195-197) first pointed out the presence within the Acanthocephala of distinct groups and showed the necessity of recognizing a number of genera to displace the old all

inclusive genus *Echinorhynchus* he founded three families; the Echinorhynchidæ, the Gigantorhynchidæ, and the Neorhynchidæ. The latter by recent change in name of the type genus becomes Neoechinorhynchidæ. Within each of these families he recognized a single genus. Since his work on this subject a long list of Acanthocephalan genera has been created but usually with the creation of a new genus the founder has neglected to point out the affinities of the genus. As a result today there are few references to groupings of genera into larger groups or families. As a start toward organizing this part of the system the writer proposes that since the genera *Centrorhynchus* and *Mediorhynchus* have the same type of proboscis receptacle and both reach sexual maturity in the alimentary canal of birds, they should be united to form a family which should take the name Centrorhynchidæ from the name of the oldest genus.

Family Centrorhynchidæ. Diagnosis. With the characters of the Class Acanthocephala. Living as mature adults in the alimentary canal of birds. Proboscis receptacle inserted near the middle of the proboscis wall.

THE AMERICAN ACANTHOCEPHALA AS A DISTINCTIVE FAUNA

The development of a typical American fauna among the Acanthocephala, independent from and in time of relatively remote separation from the European fauna, is evidenced in the extent to which the American representatives of a genus differ from the European representatives upon which by far the greater amount of work has been done. In many cases a generic diagnosis based entirely upon European representatives of a genus fails in some points of detail to permit of the inclusion of American species subsequently discovered. In the genus *Neoechinorhynchus* the two species *N. gracilisentis* (Van C.) and *N. longirostris* (Van C.) show structures and hook arrangement at considerable variance from the conditions typical of described European forms. On the other hand the three species of the genus, *N. emydis* (Leidy), *N. cylindricus* (Van C.) and *N. tenellus* (Van C.), closest in their affinities to the European species agree among themselves in possessing eight syncytial cells in the cement gland. Bieler (1913:235) has called attention to the fact that the two generally recognized Euro-

pean species *N. rutili* (Müll.), the common fresh-water species of Europe, has twelve nuclei in the cement gland, while *N. agilis* (Rud.), the marine representative of the genus, possesses eight nuclei in the cement gland of the male. These with other differences in structure of European and American *Neoechinorhynchi* would tend to indicate that the fresh-water representatives of the genus have either had (a) an independant origin on the two continents or (b) each developing from marine species of the genus at one time common to the two continents they have been separated a sufficient length of time to allow distinctive characteristics to develop in the two groups. Of these possibilities the latter seems the more plausible.

In the genus *Filicollis* the writer (1916:132) found it necessary to suggest a modification of the original characterization of the genus in order that *F. botulus* Van C. be admitted to a position near to *F. anatis* (Schrank) which general body structure and hosts of the two parasites demanded. Similarly in the genus *Arhythmorhynchus* the writer (1916a:169) has described two North American species which, though agreeing with the European species in fundamental generic characteristics, differ from them in some points of detail of structure.

Finally, in the *Centrorhynchidæ* the discovery of a new genus from North America adds still further evidence of the trend in North America toward the development of a distinctive *Acanthocephalan* fauna.

SUMMARY

A study of avian *Acanthocephala* in the Collections of the U. S. Bureau of Animal Industry has revealed four new species, one belonging to the genus *Centrorhynchus*, and three with characters such as to prevent inclusion in any known genus. For the latter a new genus, *Mediorhynchus*, has been created.

The two genera *Centrorhynchus* and *Mediorhynchus* agree in the method of insertion of proboscis receptacle, and in the fact that both occur as parasites in the alimentary canal of birds. They differ in the size, shape, and number of the cement glands of the

male; in the structure of the wall of the proboscis receptacle; and in the relations of the invertors of the proboscis to the proboscis receptacle.

Upon the basis of agreement the writer has suggested the establishing of a new family Centrorhynchidæ to include these two genera.

Evidence has been assembled to show the tendency toward the development of an Acanthocephalan fauna peculiar to terrestrial and fresh-water hosts of the North American Continent.

A key to the species of Centrorhynchidæ from North American birds is given.

KEY TO THE SPECIES OF THE FAMILY CENTRORHYNCHIDÆ FROM NORTH AMERICAN BIRDS

Acanthocephala parasitic in birds, with the proboscis receptacle inserted near the middle of the proboscis wall.—Family Centrorhynchidæ.

1. (2) Proboscis receptacle a two layered muscular sac, cylindrical, with the invertors of the proboscis passing through the posterior rounded tip and continuing backward through the body cavity as the retractors of the proboscis receptacle.—Genus Centrorhynchus. A single species, *C. spinosus*, reported from North America.
2. (1) Proboscis receptacle a single layered muscular sac with the retractors of the proboscis receptacle passing from its sides some distance anterior to the posterior tip. Receptacle not cylindrical in form. Genus Mediorhynchus3
3. (6) Anterior and posterior regions of proboscis with the same number of longitudinal rows of hooks.....4
4. (5) Twenty-four longitudinal rows of hooks on proboscis. Maximum diameter of body : length of body :: 1 : 5 (or 6).
.....*M. robustus*
5. (4) Eighteen longitudinal rows of hooks on proboscis. Maximum diameter of body : length of body :: 1 : 9....*M. papillosus*
6. (3) Twelve longitudinal rows of hooks on anterior region of proboscis; thirty on posterior region.....*M. grandis*

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EXPLANATION OF PLATES

Abbreviations used:

<i>b.</i> brain	<i>l.</i> lemnisci
<i>c. g.</i> cement gland	<i>p. r.</i> proboscis receptacle
<i>e.</i> egg mass	<i>r. p.</i> retractor of proboscis receptacle
<i>ins.</i> point of insertion of proboscis	<i>t. a.</i> anterior testis
receptacle on proboscis wall	<i>t. p.</i> posterior testis
<i>i. p.</i> inventor of proboscis	

PLATE XXXVII

Centrorhynchus spinosus nov. spec.

- Fig. 1. Type female showing body form and general arrangement of parts.
Fig. 2. Proboscis and anterior region of body, showing also insertion of proboscis receptacle and location of the retractors of the receptacle with reference to the wall.
Fig. 3. Profile of the same proboscis showing a single longitudinal row of hooks.

PLATE XXXVIII

Mediorhynchus papillosus nov. gen. et nov. spec.

- Fig. 4. Entire male from intestine of *Prozana carolina* showing arrangement of organs.
Fig. 5. Proboscis and anterior region of body, surface view, of type male from *Myiochanes virens*.
Fig. 6. Profile of proboscis shown in figure 5, showing a single longitudinal row of hooks.
Fig. 7. Posterior end of body of male in optical section showing especially the shape, number, and arrangement of the cement glands characteristic for the genus *Mediorhynchus*.
Fig. 8. Surface view of roots and papillæ from proboscis.
Fig. 9. Embryos from body of mature female.

PLATE XXXIX

- Fig. 10. *M. papillosus*. Optical section of proboscis and anterior region of body showing attachment and structure of the proboscis receptacle and course taken by invertors of the proboscis through the wall of the receptacle.
Figs. 11, 12, 13, and 14 of *Mediorhynchus grandis* nov. spec.
Fig. 11. Anterior region of body of female.
Fig. 12. Proboscis of same specimen. In surface view the delicate spines on the posterior region of the proboscis are discernable only as small circular markings.
Fig. 13. Profile of proboscis showing single longitudinal row of hooks.
Fig. 14. Embryos from body cavity of female.
Figs. 15 and 16. *Mediorhynchus robustus* nov. spec.
Fig. 15. Male in optical section showing arrangement of organs.
Fig. 16. Embryos from body cavity of female.

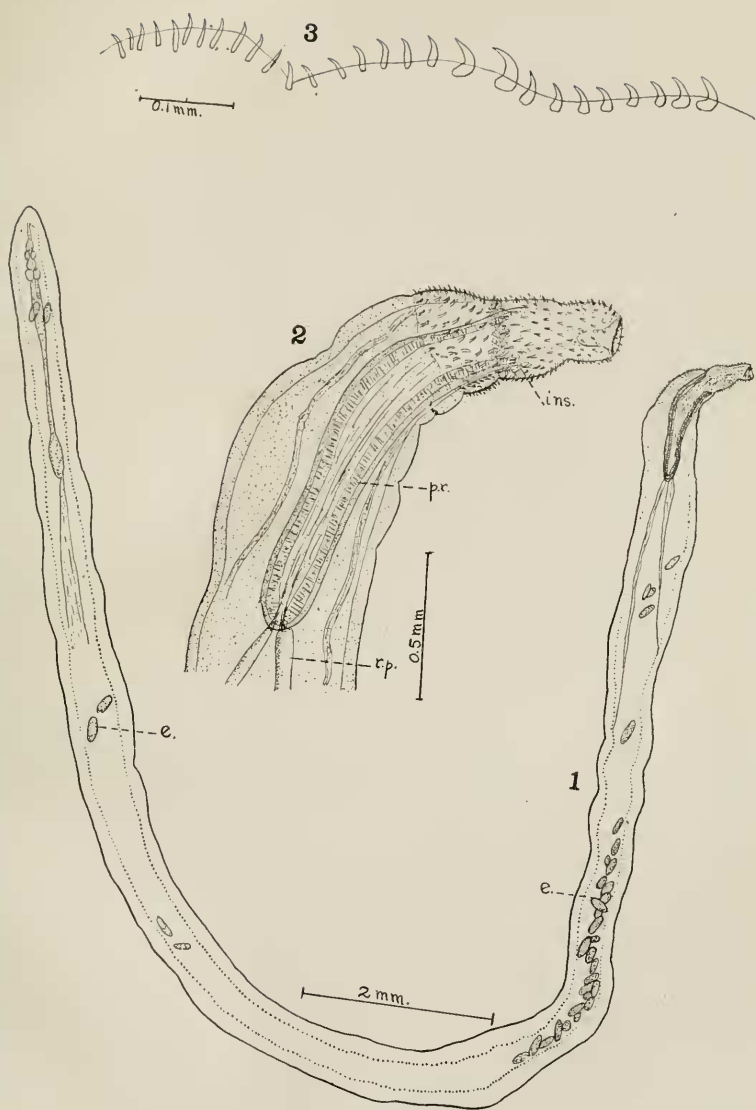


PLATE XXXVII

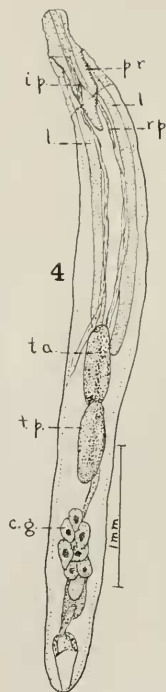
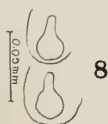
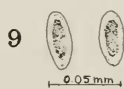
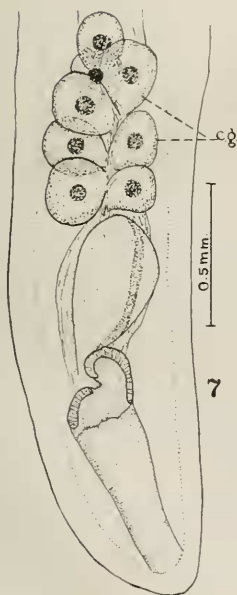
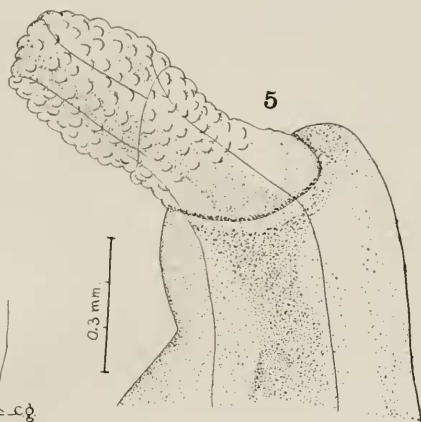
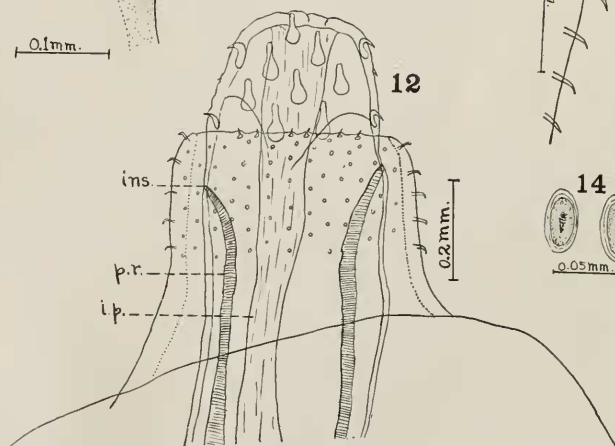
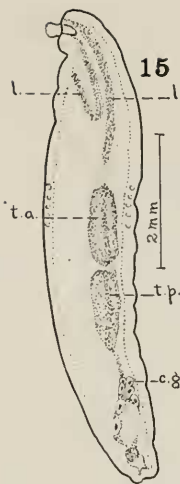
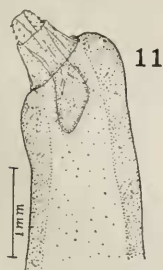
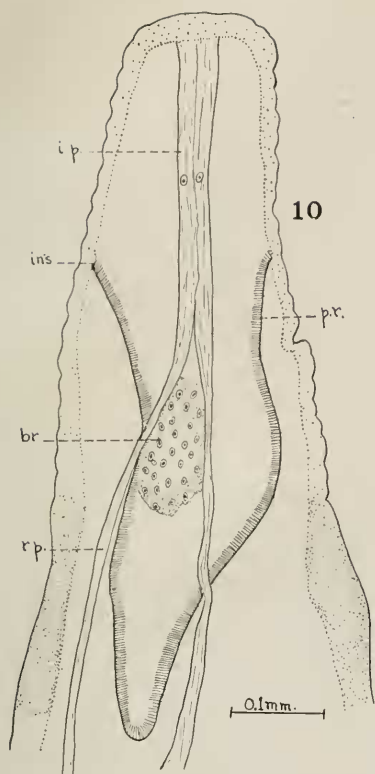


PLATE XXXVIII

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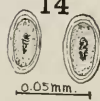


PLATE XXXIX

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